SHORT COMMUNICATION

FUNCTIONAL UROLOGY

Holmium laser enucleation of the prostate vs single-port transvesical enucleation of the prostate: Single-center comparative surgical outcomes during early adoption

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Introduction To compare the surgical outcomes of holmium laser enucleation of the prostate (HoLEP) and robotic single-port transvesical enucleation of the prostate (STEP) for the treatment of benign prostatic hyperplasia (BPH) during early adoption at a single center.

Material and methods Data about consecutive BPH patients who underwent HoLEP and STEP at our Center from July 2023 to September 2024 were retrospectively analyzed. Both procedures were performed by surgeons at the beginning of their experience with the procedures.

Results Thirty HoLEP and 20 STEP cases were included in the analysis. STEP patients had larger prostate volume (median 101.5 vs 78.5 cc; p = 0.003). Median operative time was longer for STEP (286 vs 124 min, p <0.001). Median catheterization time was shorter for HoLEP (3 vs 7 days, p <0.001). Transient post-operative incontinence was higher for HoLEP (31% vs 5.3%, p = 0.032). There was no difference in median length of stay (30 hours for HoLEP and 31 hours for STEP; p = 0.108).

Conclusions Both HoLEP and STEP can be safely implemented for the minimally invasive treatment of BPH. Each of the procedures presents some appealing features that can be tailored to different subgroups of patients. HoLEP is appealing for higher surgical risk patients, while STEP allows to effectively manage larger glands even at the beginning of the surgeon's learning curve. As experience with SP robotic surgery matures, it is likely that STEP becomes a competitive alternative to the well-established HoLEP.

Key Words: STEP ‹› single port ‹› transvesical ‹› HoLEP ‹› benign prostatic hyperplasia ‹› surgical outcomes ‹› initial outcomes

INTRODUCTION

Bladder outlet obstruction (BOO) caused by benign prostatic hyperplasia (BPH) is a common and often debilitating condition in men causing lower urinary tract symptoms (LUTS) [1]. Surgical treatment is often required in patients with moderate to severe LUTS non-responsive to medical therapy, recurrent urinary tract infections, urinary retention, bladder stones, and risk of renal insufficiency secondary to BPH [1, 2].

Holmium laser enucleation of the prostate (HoLEP) is a well-established surgical technique with good perioperative, postoperative and functional outcomes, and it is recommend as first line treatment option by current guidelines [1, 3]. One of the concerns about HoLEP is the learning curve associated with the procedure [4].

Single-port transvesical enucleation of the prostate (STEP) has been recently described as a feasible surgical option and is gaining relevance in this space [5, 6]. Comparative studies of transurethral laser enucleation of the prostate vs STEP remain very limited [7, 8].

The aim of this study was to compare the surgical outcomes of HoLEP and STEP for the treatment

of benign prostatic hyperplasia (BPH) during early adoption at a single Center.

MATERIAL AND METHODS

This was a retrospective single-center analysis of HoLEP and STEP cases done at Rush University Medical Center (Chicago, IL, USA) from July 2023 to September 2024.

The STEP procedures were performed with da Vinci Single Port (SP) System (da Vinci SP®; Intuitive Surgical Inc.) by two fellowship trained robotic surgeons with extensive experience with Multi Port robotic surgery but at the beginning of their experience with the SP system. HoLEP procedures were performed with MOSES 2.0 holmium laser (Boston Scientific) and morcellation with Wolf Piranha Morcellation system (Richard Wolf), by a single fellowship trained surgeon also at the beginning of the experience with HoLEP.

Pre-operative data collected included age, body mass index (BMI), American Society of Anesthesiology (ASA) score, Charlson Comorbidity Index (CCI), anticoagulant therapy, BPH therapy, previous prostatic surgery, post-void residue (PVR), prostate-specific antigen (PSA), prostate volume and presence of median lobe or bladder stones.

Perioperative and early postoperative data (defined as 30-days after surgery) included total operative time, estimated blood loss (EBL), specimen weight, length of stay (in hours), intra-operative complications, foley catheter stay duration (in days), post-trial of void (TOV) PVR, post-TOV retention episodes, transient incontinence after Foley removal, 30-day postoperative complications, graded according to Clavien-Dindo, and readmissions.

Statistical analysis

Statistical analysis was performed using STATA (StataCorp LLC, 4905 Lakeway Drive, College Station, TX, USA), Version 18.0. Continuous variables were reported using median and interquartile range (IQR) while categorical variables were reported as frequencies and proportions. Comparison between surgery-groups was performed with MANN-Whitney U Test for continuous variables and with Fisher's Test for categorical variables. Statistical significance was set at $p < 0.05$.

Bioethical standards

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of Rush University Medical Center.

RESULTS

A total of 30 HoLEP and 20 STEP patients were included in the analysis (Table 1). Patients treated with STEP had significantly larger prostate volume (median 101.5 cc vs 78.5 cc; $p = 0.003$), higher PSA (median 9.05 ng/ml vs 5.43 ng/ml, $p = 0.005$) and

Table 1. *Patients' characteristics, perioperative and early postoperative data*

Baseline characteristics	HoLEP (n = 30)	STEP (n = 20)	p
Age, median (IQR)	72.5 (68–77)	68 (63.5–76.5)	0.079
BMI, median (IQR)	27.56 (24.5–29.7)	26.85 (25.22–28.21)	0.699
Charlson Comorbidity Index (CCI)	4 (3–5)	3 (2–4)	**0.040**
Anticoagulant therapy	17 (56.7%)	1(5.0%)	**0.001**
Previous prostate surgery	5 (16.7%)	1 (5.0%)	0.219
PVR [ml] preoperative, median (IQR)	133 (70–250)	500 (300–784)	**0.014**
PSA [ng/ml], median (IQR)	5.43 (2.65–6.7)	9.05 (5.1–14.16)	**0.024**
Prostate volume (cc), median (IQR)	78.5 (55–105)	101.5 (91–155)	**0.004**
Bladder diverticula, n (%)	0 (0.0%)	1 (5.0%)	0.400
Bladder stones, n (%)	5 (16.7%)	1 (5.0%)	0.219
Outcomes			
Operative time [min], median (IQR)	124 (92–161)	286 (239.5–346.5)	**<0.001**
EBL [ml], median (IQR)	45 (20–50)	300 (150–500)	**<0.001**
Intra-operative complications, n (%)	0 (0.0%)	1 (5.0%)	0.400
Specimen weight [g], median (IQR)	41 (17–56)	56 (40–81)	0.069
Length of stay (hours), median (IQR)	30 (28–32)	31 (29–48)	0.252
Postoperative complications*, n (%) None Grade 2 Grade 3	 30 (100.0%) 0 (0.0%) 0 (0.0%)	 17 (85.0%) 2 (10.0%) 1 (5.0%)	 0.517
Catheterization time (days), median (IQR)	3 (1–5)	7 (6–11.5)	**<0.001**
Post-TOV PVR (ml), median (IQR)	37 (24–76)	39 (0–98)	0.873
Post-TOV retention, n (%)	3 (10%)	0 (0.0%)	0.148
Transient incontinence, n (%)	9 (30.0%)	1 (5.0%)	**0.032**
Readmission after surgery, n (%)	3 (10%)	1 (5.0%)	0.527

*According to Clavien-Dindo

BMI – body mass index; BPH – benign prostatic hyperplasia; PVR – post-void residual; PSA – prostate-specific antigen; EBL – estimated blod loss; TOV – trial of void

higher PVR (median 500 ml vs 133 ml, p = 0.028). A higher proportion of HoLEP patients were receiving anticoagulant therapy (56.7% vs 5% of STEP patients; p <0.001) and HoLEP patients had significantly higher CCI (median 4 vs 3, p = 0.040).
Median operative time was significantly longer for STEP (286 min [239.5–346.5] vs 124 min [92–161], p <0.001). EBL was also higher in STEP surgeries (median 300 ml vs 45 ml, p <0.001). Median catheterization time was shorter for HoLEP (3 days vs 7 days, p <0.001). Rate of transient post-operative incontinence was higher for HoLEP (31% vs 5.3%, p = 0.032). There was no difference in the median length of stay (30 hours for HoLEP and 31 hours for STEP (p = 0.108).

DISCUSSION

Our analysis offers several points worth discussing. In terms of surgical indication, HoLEP patients presented smaller glands at baseline and were more fragile, with a median higher CCI (4 vs 3, p = 0.040) and with about half of them receiving anticoagulant therapy. Balancing the risk of thromboembolism associated with cessation of anticoagulants vs the bleeding risk of continuing these agents around the time of surgery is challenging, but several investigations conclude that performing HoLEP on patients who require anticoagulant medication is feasible and safe although associated with increased length of catheterization and increased risk of requiring transfusion [9].
Those undergoing STEP had larger prostates and higher post-void residual volumes. The STEP procedure allowed us to tackle from the beginning larger prostate adenoma, which might suggest that the procedure might have a less steeper learning curve.
In terms of outcomes, longer operative time was observed in the STEP group. Indeed, as the prostatic volume increases, the operative time is expected to be longer as well [10]. However, while trainees were involved as console surgeons in the STEP procedure, all HoLEP procedures were entirely performed by the attending surgeon.
While hospitalization times were similar between the two procedures, both allowing the patient to be discharged the same or following day, the STEP required a longer catheter time. On the other hand, HoLEP patients reported a higher rate of transient urinary incontinence. This risk for transient incontinence is known and related, among other factors, to the surgeon's experience, as the procedure is characterized by a steep learning curve [11].
It needs to be mentioned that, in comparison with the multiport transvesical approach, for the SP robotic technique the impact of this factor is reduced, as the cystotomy is smaller. Moreover the SP robotic procedure is entirely extraperitoneal, without bowel manipulation, pneumo-peritoneum, and steep Trendelenburg positioning, which facilitates an early postoperative recovery [12]. This certainly represents a major step forwards compared to the the multiport transperitoneal robotic simple prostatectomy [13].
Our study findings are consistent with outcomes reported in the very limited literature on the comparison of transurethral vs SP robotic prostate enucleation. Talamini et al [8] studied a population of 103 patients (69 Thulep and 34 STEP) and found shorter postoperative catheter days (6 vs 3 days, p <0.0001) and decreased operative time (90 vs 180 min, p <0.0001) for laser technique and better continence rates for STEP (0 vs 13, p = 0.00). Accordingly, a recent comparative study between HoLEP and STEP [7] favored the SP approach in terms of transient incontinence at the expense of longer catheterization times. A total of 50 STEP and 90 HoLEP cases were analyzed, finding both techniques equally effective in terms of the amount of removal of obstructive prostatic adenoma. Notably, transient de novo incontinence was significantly higher in HoLEP cases (28%) compared to STEP cases (5%, p <0.01), whereas the robotic technique implied a longer catheterization time with a median of 6 days (IQR 3-7) compared to 1 day (IQR 1-1) for HoLEP (p <0.01).
Study limitations should be acknowledged. Our results reflect also our early experience with these types of BPH surgery at our Center. As the initial experience grows, we would expect improvements in post-operative outcomes using both techniques, particularly in terms of operative and catheterization times. Also, it is important to point out that supervised trainee's involvement in the cases might vary and influence the outcomes as well. Cases were performed at an academic teaching hospital and findings might vary in different hospital settings. Differences in baseline patient characteristics, such as the difference in prostate size between groups, certainly represent a selection bias. While we acknowledge that a propensity score-matched analysis would be ideal to address this bias, our cohort was not sufficient to support such methodology. Ultimately, we recognize as study limitations the small sample size of the population studied and the retrospective study design with intrinsic case selection.

CONCLUSIONS

Our findings suggest that both procedures can be safely introduced in a Center without previous

experience. Each of them presents some appealing features that can be tailored to different subgroups of patients, also considering their clinical characteristics and expectations. HoLEP is appealing for higher surgical risk patients, including those on anticoagulants. The STEP allows to effectively manage larger glands even at the beginning of the surgeon's learning curve with good overall outcomes. Patients might prefer one technique over the other after discussion about slightly longer catheter times for STEP and significantly higher risk of transient incontinence for HoLEP. In cases where a bladder diverticulectomy needs to be performed, a STEP should be preferred. Overall, the STEP procedure is emerging as a novel procedure that can be effectively included in the BPH surgical armamentarium.

CONFLICT OF INTERESTS

The authors declare no conflict of interest.

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ETHICS APPROVAL STATEMENT

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of Rush University Medical Center.

References

1. Gravas S, Gacci M, Gratzke C, et al. Summary Paper on the 2023 European Association of Urology Guidelines on the Management of Non-Neurogenic Male Lower Urinary Tract Symptoms. Eur Urol. 2023; 84: 207-222.
2. Sandhu JS, Bixler BR, Dahm P, et al. Management of Lower Urinary Tract Symptoms Attributed to Benign Prostatic Hyperplasia (BPH): AUA Guideline Amendment 2023. J Urol. 2024; 211: 11-19.
3. Fallara G, Capogrosso P, Schifano, N, et al. Ten-Year Follow-up Results After Holmium Laser Enucleation of the Prostate. Eur Urol Focus. 2021; 7: 612-617.
4. Ditonno F, Bianchi A, Fumanelli F, et al. The Learning Curve for Holmium Laser Enucleation of the Prostate: A Single-Center Analysis of Surgical And Functional Outcomes. J Endourol. 2024; 38: 1226-1233.
5. Franco A, Ditonno F, Manfredi C, et al. Robot-Assisted Single-Port Transvesical Enucleation of the Prostate: Step-by-Step Technique and Early Single-Centre Experience. BJU Int. 2024; 133: 778-782.
6. Pacini M, Lambertini L, Avesani G, et al. Single-Port Transvesical Simple Prostatectomy for the Surgical Treatment of Benign Prostatic Hyperplasia: Functional and Continence Outcomes. Prostate Cancer Prostatic Dis. 2024; doi: 10.1038/s41391-024-00923-y.
7. Palacios DA, Kaouk J, Abou Zeinab M, et al. Holmium Laser Enucleation of the Prostate vs Transvesical Single-Port Robotic Simple Prostatectomy for Large Prostatic Glands. Urology. 2023; 181: 98-104.
8. Talamini S, Lai A, Palmer C, van de Walle G, Zuberek M, Crivellaro S. Surgical Treatment of Benign Prostatic Hyperplasia: Thulium Enucleation versus Single-Port Transvesical Robotic Simple Prostatectomy. BJUI Compass. 2023; 4: 549-555,
9. Kuebker JM, Miller NL. Holmium Laser Enucleation of the Prostate: Patient Selection and Outcomes. Curr Urol Rep. 2017; 18: 96.
10. Gunseren KO, Akdemir S, Çiçek MC, et al. Holmium Laser Enucleation, Laparoscopic Simple Prostatectomy, or Open Prostatectomy: The Role of the Prostate Volume in Terms of Operation Time. Urol Int. 2021; 105: 285-290.
11. Enikeev D, Morozov A, Taratkin M, et al. Systematic Review of the Endoscopic Enucleation of the Prostate Learning Curve. World J Urol. 2021; 39: 2427-2438.
12. Abou Zeinab M, Kaviani A, Ferguson EL, et al. A Transition Toward a Faster Recovery in Single-Port Transvesical Simple Prostatectomy. J Endourol. 2022; 36: 1036-1042.
13. Pandolfo SD, Del Giudice F, Chung BI, et al. Robotic Assisted Simple Prostatectomy versus Other Treatment Modalities for Large Benign Prostatic Hyperplasia: A Systematic Review and Meta-Analysis of over 6500 Cases. Prostate Cancer Prostatic Dis. 2023; 26: 495-510. ■